The Corrector

Iteration 4 Substep 2 **January 1998**

A NEWSLETTER FOR THE NPARC USERS ASSOCIATION

What's Inside

From the Support Team

The new NPARC Alliance flow solver (WIND) is planned for release at the end of January (see more details in the article entitled "WIND 1.0 - Set for Release"). The name of the code is changing but the Alliance name remains the same. In fact, the acronym now has a meaning: National Project for Application-oriented Research in CFD.

WIND is an entirely new package, therefore the NPARC Support team is requesting that a new Memorandum of Agreement (included at the end of the newsletter) be completed by any users wanting the new flow solver. We promise to make this a quick and smooth process in getting the new code to you. Like always, ftp is the preferred method of transfer. One additional requirement has been added, you must have a DTIC number, see http://www.dtic.dla.mil.

A training class on the structure and use of WIND will be offered to the user community around June 1998. Watch for more details to be posted on the WWW site. Please send questions and inquiries about this training to the email address below.

NPARC v3.1 is now available. For information on the updates and bug fixes in v3.1, see the article below entitled "NPARC - Version 3.1". Support for NPARC v3.0 and v3.1 is scheduled to continue at least through the end of 1998.

To let us know what you think or for support questions, the NPARC support team can be contacted at:

e-mail:
nparc-support@info.arnold.af.mil

phone:
(931)-454-7455

WWW:
http://info.arnold.af.mil/nparc

NPARC and the CHSSI Program

The NPARC team has been working for over a year with representatives from the High Performance Computing Modernization Program (HPCMP). The result was the inclusion of the NPARC effort in this year's Software Support Initiative (CHSSI) Program as CFD-7. The CHSSI funding will enable the development of the NPARC suite of codes to run efficiently on a wide range of HPC and scaleable platforms. Under this effort, the Air Force Research Laboratory, specifically Steve Scherr (AFRL/VAAC), will be providing expertise for scaleable parallel computing and will participate in software testing. The Boeing Company will also contribute to the scaleable parallel development through a consulting role and will be active in the software testing as well. The result will be a more capable code for use by members of the Alliance as we work towards our vision of becoming **The Computational Tool of Choice for Aerospace Flow Simulation.**

WIND 1.0 - Set for Release

AEDC, NASA LeRC, and Boeing have been heavily involved over the past year in preparing the new NPARC Alliance flow solver, WIND, for release in early 1998. This program is the result of combining the capabilities of three widely-used, production-oriented CFD flow solver codes, NASTD from Boeing, NXAIR from AEDC, and NPARC 3.0. WIND version 1.0 is expected to have all of the NASTD capability, nearly all of the NPARC capability and about 90% of the NXAIR capability. 100% capability merger will be completed during 1998.

WIND 1.0 is completely different from NPARC 3.0 both from a programmer and user perspective. Most users will find the changes for the better. First, there is now a GUI based preprocessor, GMAN, for setting boundary conditions and grid block connectivity. GMAN, developed by Boeing St. Louis, reads a grid generated by the user. The user can then display surfaces and set boundary conditions interactively. Utilities are provided to convert PLOT3D and NPARC grid files to the WIND Common File format. For backward compatibility, NPARC input files can be read to set the WIND BCs.

The WIND code itself is executed via a flexible script interface which sets the environment for submitting to queues and for multi-processing. The code can be executed in parallel on workstation clusters and on dedicated MIMD machines. Parallelization is accomplished by distributing grid blocks to individual processors via a master/worker approach, similar to NPARC 3.0. Fault tolerance and static load balancing provide robust and efficient parallel execution.

Improvements over NPARC 3.0 include real gas chemistry, fast time accurate simulation capability, the SST turbulence model (a hybrid k-omega/k-epsilon model), more accurate block boundary treatment, and overlapped (Chimera) block capability.

After execution, there are several utilities and a postprocessing package (CFPOST) to manipulate and view the results. CFPOST allows the user to convert the WIND grid and solution files to PLOT3D files for viewing using most visualization packages. CFPOST can also be used to integrate the solution to determine forces, flow rates, etc. and for rudimentary viewing of the solution.

All of the software packages provided with WIND 1.0 provide a complete flow simulation system when combined with the user's favorite grid generation and visualization tool. The code itself is written in a modular fashion, providing a development tool for in-house development and research. Optimized executables will be distributed to users and source code is available for the developer community.

Complete documentation is available on the Web. Hyperlinks allow the user to easily navigate the user documentation for GMAN, WIND, and CFPOST. Postscript files of the documentation are also available for generating hardcopies.

Future developments on the horizon include wall functions, improved boundary condition setting capability, a programmer's guide, improved real gas chemistry, and improvements to the parallel capability to meet High Performance Computing scalability goals. Look for more information on the NPARC Web site.

Validation Activities

Anticipating the advent of the WIND code, validation efforts on NPARC Version 3.0 were terminated last spring. All current NPARC Alliance validation efforts are now aimed at the next-generation flow solver WIND.

Current validation efforts involve four main areas of concentration.

1) Review of existing validation archives and published validation guidelines,

2) Updating of the existing archive, including the guidelines,

3) Replication of several existing "model" and "example" cases with WIND and related codes, and

4) Development of a plan for validating new capabilities of WIND.

The ultimate goal of the first effort is to develop a high quality validation process that is accepted and suitable for use by the entire CFD community. While the Alliance realizes the importance of thoroughness in the validation process, we also desire to minimize the man-hour resources required for re-validation of the core capabilities of a code after modifications. This effort involves both short-term and long-term activities.

The second effort aims to improve the structure and usability of the validation archive. Effective use of the World-Wide-Web for quick review by other researchers is essential in today' s "networked" society. A "lessons learned" document is desired to allow users to quickly review findings and recommendations for using different code features in a variety of

problems. This effort will follow the initial reviews of effort 1, and will be ongoing indefinitely.

The third effort involves actually running flow solvers on specific "model" and "example" problems, fully documenting them, and adding them to the archive. Several additional flow solvers, for example NXAIR, will be included in this work, since their capabilities, such as Chimera overlapped grids, are currently being added to WIND. This is essential in order to ensure successful integration of NPARC, NASTD, NXAIR, and other codes which may contribute to the ultimate WIND code. Specific cases are being executed now; the effort will continue throughout the year.

The last effort is a long range task. Close communication will be maintained with the NPARC Alliance Development team to ensure that all new capabilities are included in the validation plan. Appropriate test cases will be identified and prioritized so that the cases may be completed, documented, and published as efficiently as possible.

Whenever an Alliance user notes a validation need, finds trusted validation data, runs/reruns a validation case, or realizes a way to improve the validation process or the archives, everyone in the Alliance needs to be informed. If you are that user, please contact the NPARC Support team and inform them of your activity. This can be done through e-mail or by phone (see page 1). The NPARC Alliance is most effective if we maintain communication, not only on new developments, but also on our confidences and questions about the codes.

The URL for the NPARC validation archive is:

http://info.arnold.af.mil/nparc/Archive_information.html

A New Logo for the Alliance

The NPARC Alliance logo has changed slightly (see cover page) to reflect the growth and evolution of the Alliance and its activities. While the old logo reflected the air breathing propulsion emphasis in the organizations sponsoring the Alliance, the new logo reflects the growing use of the NPARC Alliance software for external aerodynamics and the expansion of Alliance participants in government and industry. A wing is now present, without de-emphasizing the propulsion system. Also, to reflect the growing participation in Alliance activities, the names of the founding members, AEDC and NASA LeRC, have been removed in favor of the more inclusive participants: Government, Industry, and Academia. New pins are available with the new logo, but hang on to the old ones, they will be collectors items some day.

NPARC - Version 3.1

NPARC version 3.1, the latest version of the original NPARC code, was released in November 1997. New capabilities focus on solving unsteady flows. A Newton iterative method was added to enhance the implicit method to second-order time accuracy. NPARC v3.1 can also simulate moderate grid motion due to the rigid-body motion or deformation of the boundary grid. The grid is regenerated at each time step to accommodate the motion of the boundary grid. The flow equations sense the moving grid through the grid velocities, which are computed from a time-difference of grids at two consecutive time levels. For three-dimensional flows, the grid is required to be “quasi”-2d or axisymmetric in the region of the block bounded by the moving grid. The NPARC v3.1 user's guide provides further details on the new capabilities and can be viewed from the NPARC WWW home page. To obtain NPARC v3.1, contact the NPARC support team for authorization.

User Association Meetings

The 9th and 10th NPARC User’s Association Meeting were held in conjunction with the AIAA Applied Aerodynamics Conference held in Atlanta, Georgia in June and the AIAA/ASME/SAE/ASEE Joint Propulsion Conference during the July meeting in Lake Buena Vista, Florida. The gathering in Atlanta was attended by approximately 20 people and provided a forum for familiarizing new users with the Vision and Structure of the NPARC Alliance. The same briefing was given to both audiences. A review of the status of the Support, Development and Validation activities were presented. A brief history describing how and why the WIND code was conceived, the development approach taken to combine the capabilities of the three codes, NPARC, NXAIR, and NASTD, and a list of expanded capabilities for WIND. The item receiving the greatest attention was the development, capabilities, and release of the WIND code.

The following is a list of upcoming NPARC User’s Association meetings:

June 15-18, 1998
AIAA Applied Aerodynamics Conference
Albuquerque, NM

NPARC User's Meeting

July 13-15, 1998
AIAA Joint Propulsion Conference
Cleveland, OH

One NPARC Technical Session

NPARC User's Meeting

January, 1999
AIAA Aerospace Sciences Meeting
Reno, NV

One NPARC Technical Session

NPARC User's Meeting

Please plan to attend one of the User's meeting to let your views be known. You are also encouraged to contribute to the NPARC technical sessions to communicate your experiences to other users.

Frequently Asked Questions

The following are some of the more frequently asked questions of the user support team.

How do I get a copy of the new flow solver, WIND, that is supported by the NPARC Alliance?

To receive the WIND code, all NPARC users are being asked to resubmit a new Memorandum of Agreement. To get this form we have included it with this newsletter or you can send the NPARC Support team your fax number and it will be faxed to you.

Will WIND run on my PC? What platforms are currently supported?

The WIND code does not currently run on a PC. There are plans to make it execute on a PC this FY. Check the "HOTNEWS" located on the NPARC WWW's home page for late breaking information.

Currently WIND operates on the following hardware platforms:

Silicon Graphics (IRIX 5.x and 6.x)

Hewlett-Packard

Convex

Cray C90, J90

IBM RS 6000

Dec Alpha

Sun

SPP

Does WIND support all of the NPARC Boundary Conditions?

Nearly all of the current NPARC boundary conditions in version 3.0 are available with WIND. A document describing the relationship between NPARC and WIND boundary conditions can be found at the NPARC website.

How can I translate from an NPARC solution to WIND?

You can translate the grids and solutions by generating Plot3d files, then using the utility "cfcnvt", provided with WIND , to generate the WIND common file. With this approach, you must reconstruct all boundary conditions.

Alternatively you can translate the NPARC restart file and input file directly into WIND common files using the utility "b4wind". b4wind also allows the user to generate custom initial conditions for WIND.

NOTES

Memorandum of Agreement

AEDC Software Release

U.S. Government

Date:

1. On behalf of the U.S. Government agency listed below, I request release of the following US Air Force software package (computer programs, system description, and documentation):

Distribution format and media:

The requested software package will be used as follows:

2. I understand that the requested software package contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, *et seq*) or Executive Order 12470, and that violations of these export laws are subject to severe criminal penalties. Further dissemination of this software is controlled under DoDD 5230.25 and AFI 61-204, and is limited to object or executable code.

Requester

Signature:
Printed Name:
Requesting Organization:
Address:
City, State and ZIP Code:

Requester: Technical Contact

Name:
Phone Number:
E-Mail Address:

AEDC OPR Certification / Verification

Name, Initials, and Date:

AEDC Software Release Authority

Signature:
Printed Name:
Test Operations Directorate Arnold AFB, TN 37389-9010

Memorandum of Agreement

AEDC Software Release

U.S. Commercial & Educational and Canadian Organizations

Date:

1. I/we the undersigned, on behalf of the Requesting Organization listed below (hereafter referred to as the "Requester"), request release of the following US Air Force software package (computer programs, system description, and documentation, collectively, the "Package"):

Distribution format and media (default - electronic dissemination via Internet, FTP, etc.)

The requested software package will be used as follows:

2. I/we understand that the Package may be subject to limited rights or other restrictions or constraints. In consideration therefore, the Requester agrees:

   a) The Requester shall not knowingly release or disclose the Package to third parties (other than the Requesting Organization).

   b) To strictly abide by and adhere to any and all restrictive markings placed on the Package.

   c) That any restrictive markings on the Package shall be included on all copies, modifications, and derivative works, or any parts or options thereof, in any form, manner or substance, which are produced by the Requester including but not limited to incorporation of the Package into any other data, technical data, computer software, computer software documentation, computer programs, source code, or firmware, or other information of like kind, type or quality. In all such events, Requester shall clearly denote where such Package derived data initiates and concludes by use of annotations or other standard markings.

3. The Requester and the Software Release Authority agree that:

   a) No guaranties, representations, or warranties either express or implied shall be construed to exist in any language, provision, or term contained in these materials or in any other documentation provided herewith (all such items are collectively referred to as the "Agreement"), and furthermore, the releasing organization disclaims and the Requester waives and excludes any and all warranties of merchantability and any and all warranties of fitness for any particular purpose.

   b) The Requester shall obtain from the releasing organization all of the Package (defined in paragraph 1 above), or any other products or services contemplated by the Agreement, in an "as is" condition.

4. The Requester's use of the Package shall not prevent the Government from releasing the Package at any point in the future.

5. The Requester shall not offer the released Package or any modified version thereof for resale to the Government, in whole or as part or subpart of a Government deliverable, without explicitly stating that he is

doing so by providing certification documentation (e.g., Section K of the Government solicitation) to the contracting officer before contract award.

6. The Requester may use the released Package in a contract with the Government, but understands that the Government shall not pay the Requester for rights of use of such Package in performance of Government contracts or for the later delivery to the Government of such Package. The Requester may be entitled to compensation for converting, modifying, or enhancing the Package into another form for reproduction and delivery to the Government, if authorized under a contract with the Government.

7. The Requester is not entitled to any released Package that is subject to national defense security classification or the proprietary rights of others. The Requester shall report promptly the discovery of any such restricted material included with the Package to the US Air Force Software Release Authority below, and will follow all instructions concerning the use, safeguarding, or return of such material. The Requester shall not copy, or make further study or use of any such material later found to be subject to such restrictions.

8. I/we understand that the Package received is intended for domestic use (US and Canada) only. It will not be made available to other foreign owned or controlled corporations, or other foreign governments; nor will it be used in any contract with another foreign government.

9. The Requester and the Software Release Authority intend that all agreements under this Memorandum of Agreement shall be governed by the laws of the United States of America.

10. The undersigned Requester has the authority to bind the requesting organization to the terms of this Agreement.

Requester

Signature:
Printed Name:
Requesting Organization:
Address:
City, State and ZIP Code:

Requester: Technical Contact

Name (if different from Requester):
Phone Number:
E-Mail Address:

AEDC OPR: Export-Control Info

Export Control Number & Expiration Date::
Data or Document Custodian's Name:
Phone Number:
E-Mail Address:

AEDC OPR: Certification/Verification

Name, Initials, and Date:

AEDC Software Release Authority

Signature:
Printed Name:
Test Operations Directorate Arnold AFB, TN 37389-9010